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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/523,974	02/08/2005	Haruhiko Furuya	265523US2PCT	1564

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EXAMINER	
MALDONADO, JULIO J	

ART UNIT	PAPER NUMBER
2823	

NOTIFICATION DATE	DELIVERY MODE
12/13/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/523,974	FURUYA ET AL.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 October 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,7-17,19 and 20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,7-17,19 and 20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 October 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The cancellation of claims 4-6 and 18, and the addition of claims 19 and 20 as set forth in the reply filed on 10/01/2007 is acknowledged.

2. Claims 1-3, 7-17, 19 and 20 are pending in the application.

Drawings

3. The drawings were received on 10/01/2007. These drawings are acceptable.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-3, 7, 9-11 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuno et al. (U.S. 5,728,629, hereinafter Mizuno) in view of the following arguments.

In reference to claim 1, Mizuno teaches a method of forming a conductive layer over a substrate including the steps of controlling temperature of a first substrate to be at a process temperature inside a process container (Mizuno, column 8, lines 18 – 26), while supplying a process gas into the process container, thereby subjecting the first substrate to a semiconductor process, during which a by-product film is formed on an inner surface of the process container (Mizuno, column 6, lines 20 – 37); subsequently to the semiconductor process and unload of the first substrate out of the process container, supplying a gas for oxidizing the by-product film as a reforming gas into the

process container, thereby subjecting the by-product film to a reformation process (Mizuno, column 6, lines 20 – 37); and subsequently to the reformation process, controlling temperature of a second substrate to be at the process temperature inside the process container, while supplying the process gas into the process container, thereby subjecting the second substrate to the semiconductor process (Mizuno, column 7, lines 32 – 43).

Mizuno fails to expressly disclose wherein said reformation process is set to reduce thermal reflectivity of the by-product film. However, Mizuno teaches wherein the reformation process comprises an oxidation of the titanium nitride by-product (Mizuno, column 7, lines 23 – 31). Furthermore, in page 22, lines 6 – 22 of the disclosed specification, applicants teach, "...The oxygen thus supplied into the inner tube 3 is activated by heat inside the process container 2, and oxidizes the by-product film deposited inside the process container 2 and containing titanium nitride as the main component. As a consequence, the by-product film is reformed into a film containing titanium oxide as the main component. The titanium nitride film is auburn (a color between purple and brown), and therefore has a high thermal reflectivity (low light transmission). By contrast, the titanium oxide film is white, and therefore has a low thermal reflectivity (high light transmission). As described previously, in apparatuses of the hot wall type, the thermal reflectivity of a by-product film is high where the color of the film is deep, such as brown, and the thermal reflectivity decreases as the color of the film is closer to white or transparent...". Therefore, since Mizuno teaches the same

reformation process, Mizuno inherently teaches wherein the reformation process reduces thermal reflectivity of the by-product film.

Mizuno fails to expressly disclose wherein said by-product film contains at least 50% titanium nitride and wherein oxidizing said titanium nitride by-product results into a film containing at least 50% titanium oxide. However, the selection of the titanium nitride by-product or titanium oxide by-product is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to result in a passivated layer. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using Mizuno to arrive at the recited limitations through routinary experimentation.

In reference to claim 2, Mizuno inherently teaches wherein the reformation process is set to change color of the by-product film to white.

In reference to claim 3, Mizuno inherently teaches wherein the reformation process is set to change light transmission of the by-product film to be 70% or more.

In reference to claim 7, Mizuno teaches wherein the reforming gas comprises oxygen (Mizuno, column 9, lines 10 – 12).

In reference to claim 9, Mizuno teaches in a preferred embodiment of the invention wherein the reformation process and the semiconductor process are alternately repeated (Mizuno, column 7, lines 32 – 42).

In reference to claim 10, Mizuno teaches in a less preferred embodiment of the invention wherein the reformation process is performed after the semiconductor process is repeated a plurality of times without the reformation process (Mizuno, column 7, lines

32 – 42). Although not taught as a preferred embodiment, Mizuno teaches this embodiment nonetheless, and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 169 USPQ 423 (CCPA 1971). "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). Even a teaching away from a claimed invention does not render the invention patentable. See Celeritas Technologies Ltd. v. Rockwell International Corp., 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998), where the court held that the prior art anticipated the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed." To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose.

In reference to claim 11, Mizuno teaches wherein the semiconductor process forms a titanium nitride layer by a CVD process (Mizuno, column 7, lines 44 – 48).

In reference to claim 20, Mizuno inherently teaches wherein the reformation process is set to change light transmission of the by-product film to be 70% or more.

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuno ('629) as applied to claims 1-3, 7, 9-11 and 20 above, and further in view of Basceri et al. (2006/0244027 A1, hereinafter Basceri) and Koike et al. (U.S. 6,667,537 B1, hereinafter Koike).

Mizuno substantially teaches all aspects of the invention but fails to disclose the deposition temperature of the titanium nitride layer.

However Basceri teaches a method of forming titanium nitride layers including chemical vapor depositing titanium nitride at a temperature of about 600°C (Basceri [0071]).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno and Basceri to enable the deposition of the titanium nitride layer of Mizuno to be performed according to the teachings of Basceri because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of depositing the disclosed titanium nitride of Mizuno and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Mizuno and Basceri fail to disclose wherein the reformation process is performed at a reforming temperature higher than the process temperature.

However, Koike teaches a method of manufacturing a semiconductor device including depositing a titanium nitride layer over a substrate at a temperature of 180°C

(Koike, column 9, lines 62 – 67), and oxidizing said titanium nitride layer at a temperature of 400°C – 700°C (Koike, column 10, lines 50 – 55). I

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno and Koike to enable forming and oxidizing the titanium nitride layer of Mizuno according to the teachings of Koike because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of forming and oxidizing the disclosed titanium nitride layer of Mizuno and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

7. Claims 12-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuno ('629) in view of Basceri ('027) and Koike ('537).

In reference to claim 12, Mizuno teaches a method of forming a conductive layer over a substrate including the steps of controlling temperature of a first substrate to be at a process temperature inside a process container (Mizuno, column 8, lines 18 – 26), while supplying a process gas into the process container, thereby forming a metal nitride on the first substrate by a chemical vapor deposition (CVD) process, during which a metal nitride is formed on an inner surface of the process container (Mizuno, column 6, lines 20 – 37); subsequently to the CVD process and unload of the first substrate out of the process container, supplying a reforming gas into the process container, thereby subjecting the by-product film to a reformation process (Mizuno, column 6, lines 20 – 37); and subsequently to the reformation process, controlling temperature of a second substrate to be at the process temperature inside the process

container, while supplying the process gas into the process container, thereby subjecting the second substrate to the CVD process (Mizuno, column 7, lines 32 – 43).

Mizuno fails to expressly disclose wherein said reformation process is set to reduce thermal reflectivity of the by-product film. However, Mizuno teaches wherein the reformation process comprises an oxidation of the titanium nitride by-product (Mizuno, column 7, lines 23 – 31). Furthermore, in page 22, lines 6 – 22 of the disclosed specification, applicants teach, "...The oxygen thus supplied into the inner tube 3 is activated by heat inside the process container 2, and oxidizes the by-product film deposited inside the process container 2 and containing titanium nitride as the main component. As a consequence, the by-product film is reformed into a film containing titanium oxide as the main component. The titanium nitride film is auburn (a color between purple and brown), and therefore has a high thermal reflectivity (low light transmission). By contrast, the titanium oxide film is white, and therefore has a low thermal reflectivity (high light transmission). As described previously, in apparatuses of the hot wall type, the thermal reflectivity of a by-product film is high where the color of the film is deep, such as brown, and the thermal reflectivity decreases as the color of the film is closer to white or transparent...". Therefore, since Mizuno teaches the same reformation process, Mizuno inherently teaches wherein the reformation process reduces thermal reflectivity of the by-product film.

Mizuno fails to expressly disclose wherein said by-product film contains at least 50% titanium nitride and wherein oxidizing said titanium nitride by-product results into a film containing at least 50% titanium oxide. However, the selection of the titanium

nitride by-product or titanium oxide by-product is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to result in a passivated layer. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using Mizuno to arrive at the recited limitations through routinary experimentation.

Mizuno substantially teaches all aspects of the invention but fails to disclose the deposition temperature of the titanium nitride layer. However Basceri teaches a method of forming titanium nitride layers including chemical vapor depositing titanium nitride at a temperature of about 600°C (Basceri [0071]). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno and Basceri to enable the deposition of the titanium nitride layer of Mizuno to be performed according to the teachings of Basceri because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of depositing the disclosed titanium nitride of Mizuno and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Mizuno and Basceri fail to disclose wherein the reformation process is performed at a reforming temperature higher than the process temperature. However, Koike teaches a method of manufacturing a semiconductor device including depositing a titanium nitride layer over a substrate at a temperature of 180°C (Koike, column 9, lines 62 – 67), and oxidizing said titanium nitride layer at a temperature of 400°C – 700°C (Koike, column 10, lines 50 – 55). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno

and Koike to enable forming and oxidizing the titanium nitride layer of Mizuno according to the teachings of Koike because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of forming and oxidizing the disclosed titanium nitride layer of Mizuno and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In reference to claim 13, the combined teachings of Mizuno, Basceri and Koike teach wherein the reforming gas comprises oxygen (Mizuno, column 9, lines 10 – 12).

In reference to claims 14-16, the combined teachings of Mizuno, Basceri and Koike teach wherein the titanium nitride layer is deposited using titanium tetrachloride ($TiCl_4$) and ammonia (NH_3) (Basceri, [0071]).

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuno ('629) in view of Basceri ('027) and Koike ('537) as applied to claims 12-16 above, and further in view of the applicants admitted prior art (hereinafter the prior art) and Mizuno (U.S. 2006/0121746 A1, hereinafter Mizuno2).

The combined teachings of Mizuno, Basceri and Koike teach wherein the titanium nitride deposition is performed at a temperature of 500 to 800°C (Basceri, [0071]) but fail to disclose wherein the process container is configured to accommodate a plurality of target substrates at intervals in a vertical direction, the target substrates are heated by a heater disposed around the process container, and the by-product film is present between the target substrates and the heater.

However, the prior art (Fig.7) teaches forming a titanium nitride layer in a process container, wherein said process container configured to accommodate a plurality of target substrates (54) at intervals in a vertical direction, the target substrates (54) are heated by a heater (53) disposed around the process container, and the by-product film is present between the target substrates and the heater (prior art, page 2, line 6 – page 4. line 7).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno, Basceri and Koike with the prior art to enable the formation of the titanium nitride layer to be performed according to the teachings of prior art because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of forming the disclosed titanium nitride layer and art recognized suitability for an intended purpose has been recognized to be motivation to combine (MPEP 2144.07), and because this would enable the formation of titanium nitride layers in a plurality of wafers all together (prior art, page 2, lines 1 – 3).

The combined teachings of Mizuno, Basceri, Koike and the prior art fail to disclose wherein the process container is light-transmitting.

However, Mizuno2 (Fig.1) teaches a deposition process including a deposition apparatus (1), wherein said apparatus (1) includes a quartz inner tube (12), which is light transmitting, a quartz outer tube (1) (Mizuno2, [0038]).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno, Basceri, Koike and the prior art with Mizuno to enable the

performing the deposition process of Mizuno, Basceri, Koike and the prior art using the apparatus according to Mizuno2 because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful methods of performing the disclosed deposition step of Mizuno, Basceri, Koike and the prior art and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

9. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuno ('629) as applied to claims 1-3, 7, 9-11 and 20 above, and further in view of the prior art and Mizuno2 ('746).

Mizuno substantially teaches all aspects of the invention but fails to disclose but fail to disclose wherein the process container is configured to accommodate a plurality of target substrates at intervals in a vertical direction, the target substrates are heated by a heater disposed around the process container, and the by-product film is present between the target substrates and the heater.

However, the prior art (Fig.7) teaches forming a titanium nitride layer in a process container, wherein said process container configured to accommodate a plurality of target substrates (54) at intervals in a vertical direction, the target substrates (54) are heated by a heater (53) disposed around the process container, and the by-product film is present between the target substrates and the heater (prior art, page 2, line 6 – page 4. line 7).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno and the prior art to enable the formation of the titanium nitride

layer to be performed according to the teachings of prior art because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of forming the disclosed titanium nitride layer and art recognized suitability for an intended purpose has been recognized to be motivation to combine (MPEP 2144.07), and because this would enable the formation of titanium nitride layers in a plurality of wafers all together (prior art, page 2, lines 1 – 3).

The combined teachings of Mizuno and the prior art fail to disclose wherein the process container is light-transmitting.

However, Mizuno2 (Fig.1) teaches a deposition process including a deposition apparatus (1), wherein said apparatus (1) includes a quartz inner tube (12), which is light transmitting, a quartz outer tube (1) (Mizuno2, [0038]).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Mizuno, and the prior art with Mizuno to enable the performing the deposition process of Mizuno and the prior art using the apparatus according to Mizuno2 because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful methods of performing the disclosed deposition step of Mizuno and the prior art and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Response to Arguments

10. Applicant's arguments filed 10/01/2007 have been fully considered but they are not persuasive.

Applicants argue, "...the applied art does not teach or suggest supplying a process gas into a process containing to subject the first substrate to a semiconductor process, during which a by-product film containing at least 50% titanium nitride is formed on an inner surface of the process container, and subsequently supplying a gas for oxidizing the by-product film as a reforming gas into the process containing, thereby subjecting the by-product film by transforming the by-product film into a first containing at least 50% titanium oxide...".

In response to this argument, as mentioned hereinabove, the selection of the titanium nitride by-product or titanium oxide by-product is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to result in a passivated layer. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the prior art of record to arrive at the recited limitations through routinary experimentation.

Applicants also argue, "...metals, such as titanium, are chemically more stable (more passive) in a forms of nitride than in a form of oxide, Accordingly, if the teachings of Mizuno are applied to a titanium nitride by-product film, passivation based on adsorption may be usable, while passivation based on oxidation is illogical. Accordingly Mizuno teaches away from the features of the claimed invention...".

In response to this argument, Mizuno teaches performing an oxidation process on a titanium film by-product (Mizuno, column 7, lines 23 – 31). Furthermore, there is

no disclosure in Mizuno in regards to a particular passivation process over another. Accordingly, Mizuno teaches upon the argued limitation.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (http://portal.uspto.gov/external/portal/pair) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

14. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at http://www.uspto.gov/web/info/2800.htm.

Julio J. Maldonado
Patent Examiner
Art Unit 2823

Julio J. Maldonado
December 1, 2007

GEORGE R. FOURSON
PRIMARY EXAMINER